Science and Technology in the Defence of the Country

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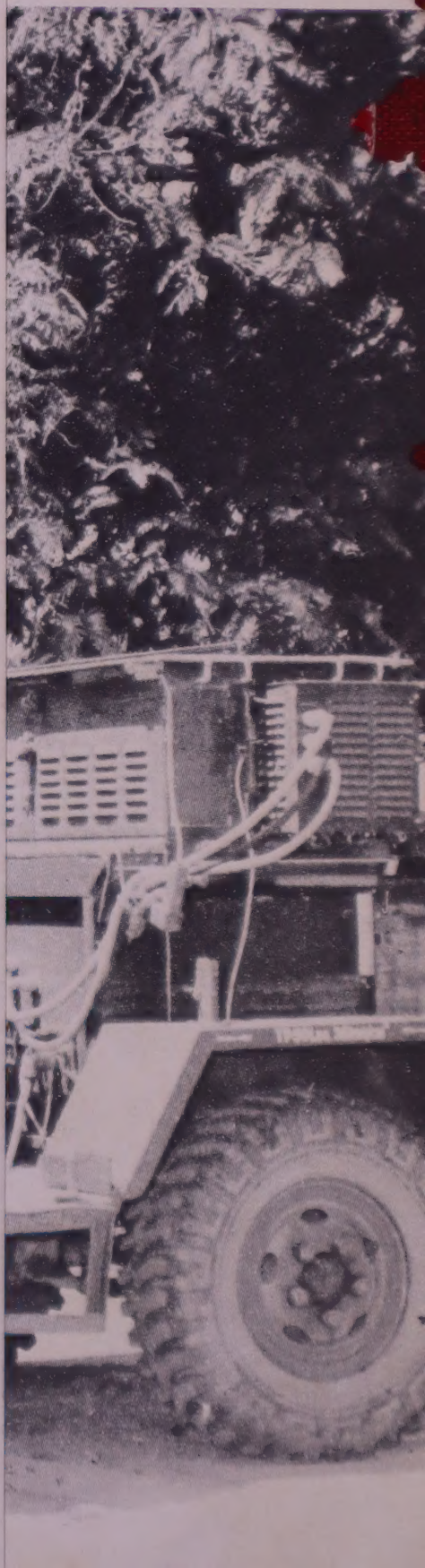
Life is not lived in compartments, nor can all-round development take place if it is so viewed. The solution of contemporary problems involves many spheres of activity. We must, therefore, encourage the cross-fertilisation of views, experience and data, and also promote interaction between different disciplines.

Smt. Indira Gandhi



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DAVP SCIENCE AND TECHNOLOGY SERIES

INTRODUCTION

It can rightly be said that within a brief span of one decade, India has broken the shackles of gravity and soared into the space age. India has also emerged in less than three decades as a world leader in the peaceful uses of atomic energy.

The youth of India should have at least a nodding acquaintance with the pioneering work which those slightly older than themselves have done to raise the country to this pinnacle of pride

Besides, there is a growing demand for trained scientific and technical personnel to carry forward the research and development (R & D) work in these and other fields of science and technology. Our high schools, colleges and universities are the obvious catchment area for this talent.

There are bright and satisfying careers awaiting students of science and technology. To them and their future this series is dedicated. DAVP acknowledges with gratitude the contribution of various Departments and Institutions on whose work and data the publications in this series are based.

G. S. P. Suri
General Editor

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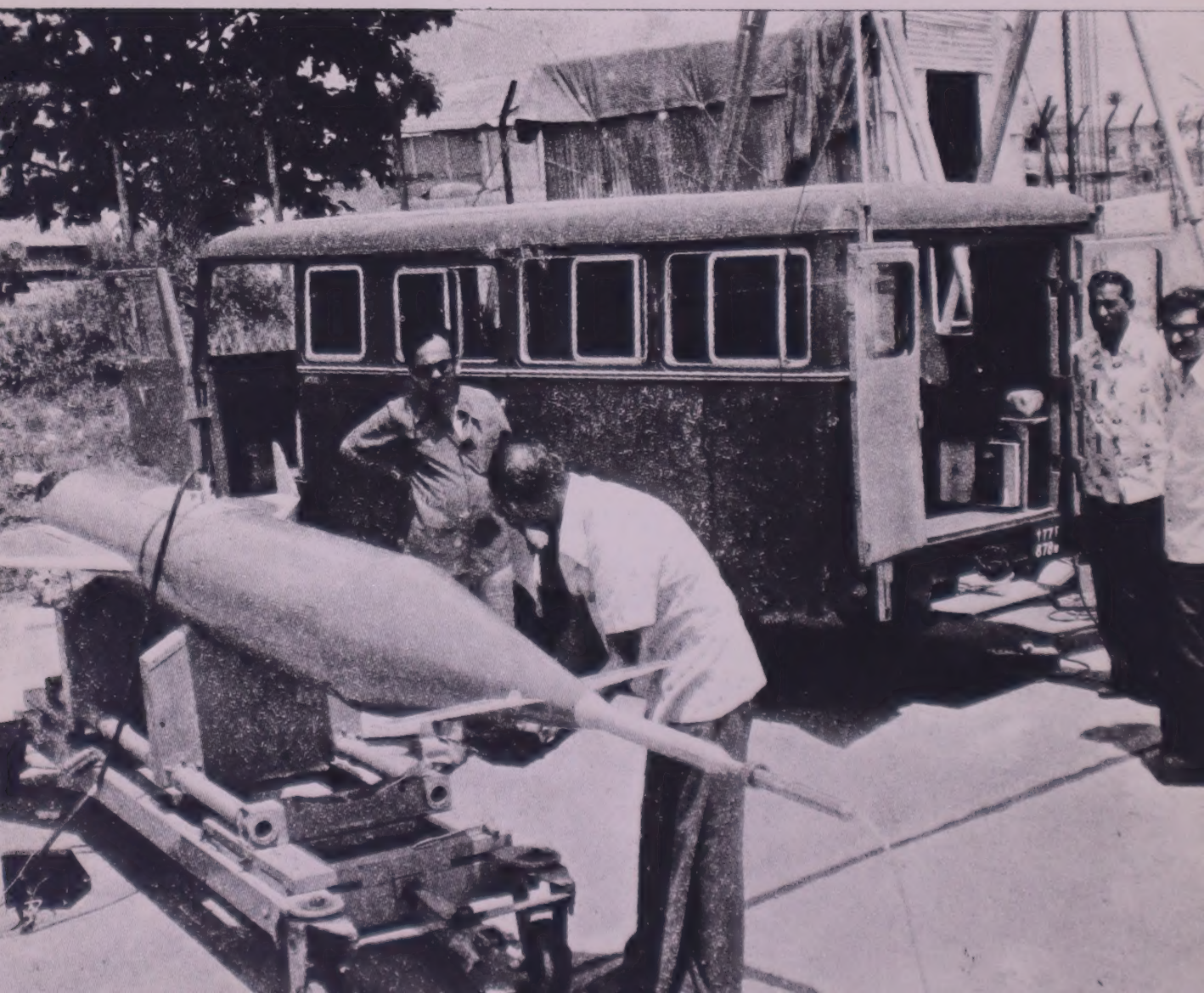
There can be no two opinions about the vital importance of the Defence Services in the life of any nation. Moreover, it is well-known that science and technology play an extremely important role in providing the Defence Forces with the most modern and sophisticated weapons, equipment and materials.

Prior to Independence, the technical requirements of the Defence Forces we.e being provided only to a very limited extent through a number of Technical Development Establishments (TDEs). It was in 1948 that the Defence Science Organisation was set up, as it was realised that for an independent India it was not appropriate to depend on a long-term basis on imports of all that is required by the Defence Forces of the country.

In 1958, some of the TDEs were amalgamated with the Defence Science Organisation, resulting in the establishment of the Defence Research & Development Organisation (DRDO), which was then assigned the following charter of duties:

(a) To design and develop weapons using the latest discoveries in Science and to carry out applied research to solve the problems of the Services,

Missile Target Checks



(b) To design and develop weapons and equipment based on the operational requirments defined by the Services and to help in their indigenous production,

(c) To render scientific advice to the Service Headquarters,

(d) To evaluate and conduct technical trials of new weapons and equipment and those designed and developed in the country, and

(e) To render technical guidance to trade for development of new equipment.

SCOPE OF DRDO

The Defence Research & Development Organisation has built up the necessary infrastructure and competence in a variety of scientific and technological disciplines of relevance to Defence. Some of the important areas of Research & Development are: armaments, electronics, rockets and missiles, aeronautics, naval science and technology, engineering, vehicles and materials technology. To carry out design and development of sophisticated and complex weapon systems involving the technologies mentioned above, DRDO has a network of 37 well-equipped Laboratories/Establishments distributed all over the country.

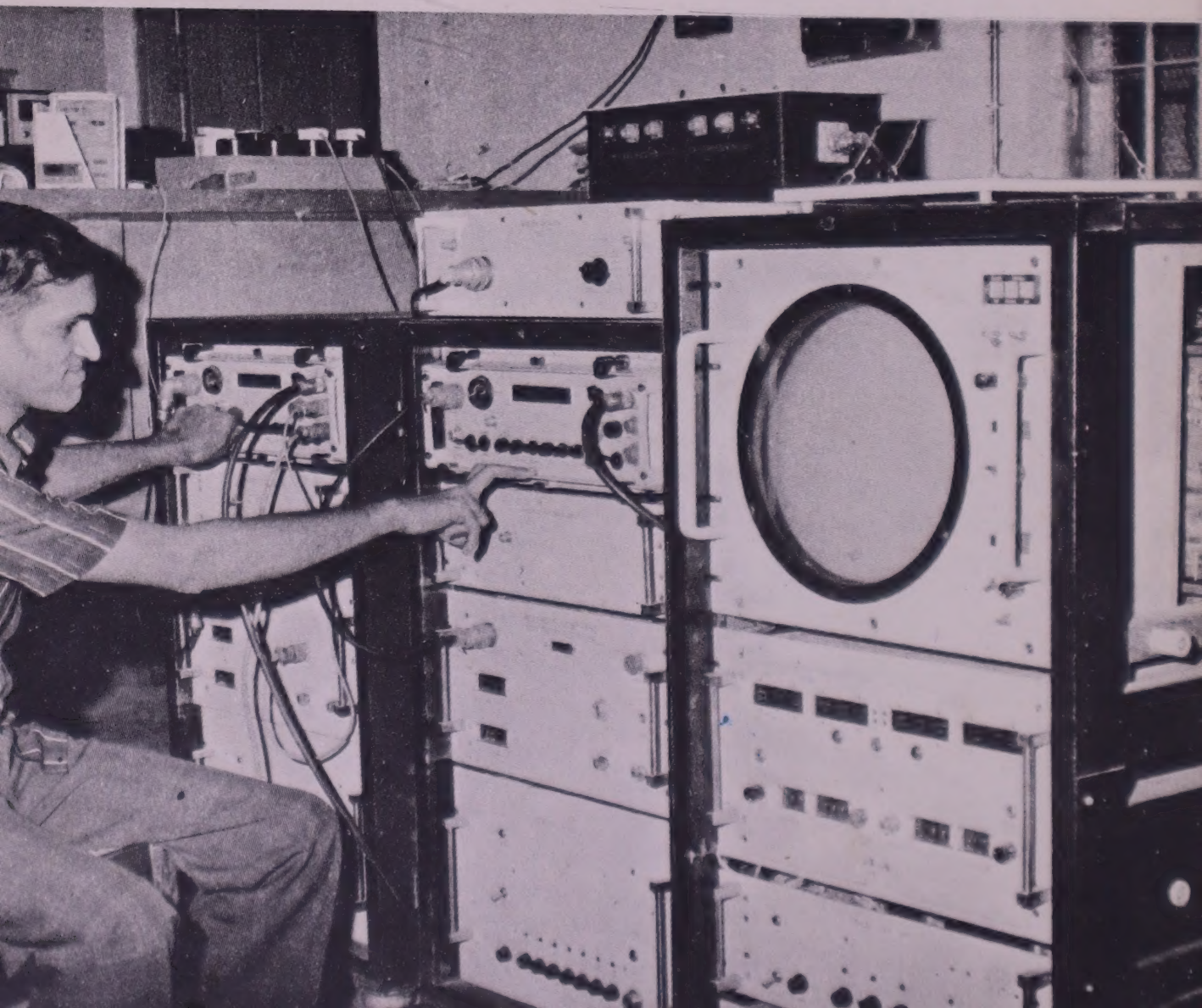
The R & D activities of DRDO can be broadly classified into two distinct categories. The projects which are based on the specific qualitative requirements projected by the Services

are called 'Staff Projects'. Simultaneously, efforts are continually in progress to build up expertise in the contemporary and futuristic technologies of relevance to defence. As distinguised from Staff Projects, these are called 'Competence Build-up Projects'.

COORDINATION WITH OTHER DEFENCE AND CIVIL AGENCIES

In addition to the various defence organisations including the Defence Services, close liaison is maintained with the civil.

Direction Finding System



academic and research institutions in the country with a view to exploit the expertise and potential available in the national scientific and technological institutions for defence work. A number of projects are farmed out to various institutions under the grants-in-aid schemes.

CIVIL APPLICATIONS OF TECHNICAL FALL-OUT OF DEFENCE EFFORTS

Whenever the processes/techniques deveoped by DRDO have civil applications in addition to defence needs, these are released to the civil trade for commercial exploitation through the National Research & Development Corporation (NRDC) of India. The technical details of the processes which are considered suitable for exploitation by private enterpreneurs or industry are forwarded to NRDC who, through their usual media, contact the interested parties. Consultancy and help, wher ever required, is given by DRDO experts in the commercial exploitation of such processes.

ARMAMENTS AND ARMOURED FIGHTING VEHICLES

The visible part of any warfare is the use of armaments and explosives but behind this activity lies a whole field of research in small arms, guns, ammunition, instruments, ballistics, etc. Some modern explosives have to be delivered by rockets and missiles. A good deal of research is necessary for the manufacture of these missiles and their propellants.

One of the prestigious projects of DRDO relates to design and development of the Main Battle Tank which will be a sophisticated and contemporary tank. The prototype of the tank is expected to be ready by the end of 1981.

Reusable Rocket Pod

Due to the efforts of DRDO, a considerable measure of self-sufficiency has been achieved in the areas of small arms and ammunition. The Ishapore rifle, the mountain gun and the Indian Field Gun Mark I to which DRDO made significant con-

tributions, are now in use. A lighter version of the field gun is presently under development. A self-propelled artillery gun has also gone into production. Various types of proximity fuses have also been developed/are under development.

The field of rockets and missiles is a high technology area, where considerable infrastructure has been set up and competence built up. Competence-building in development of inertial navigation systems, solid and liquid propulsion systems, short range rockets and missiles, augmentation of range test facilities, general build-up for development of rockets and missile technology and specific hardware projects have been undertaken.

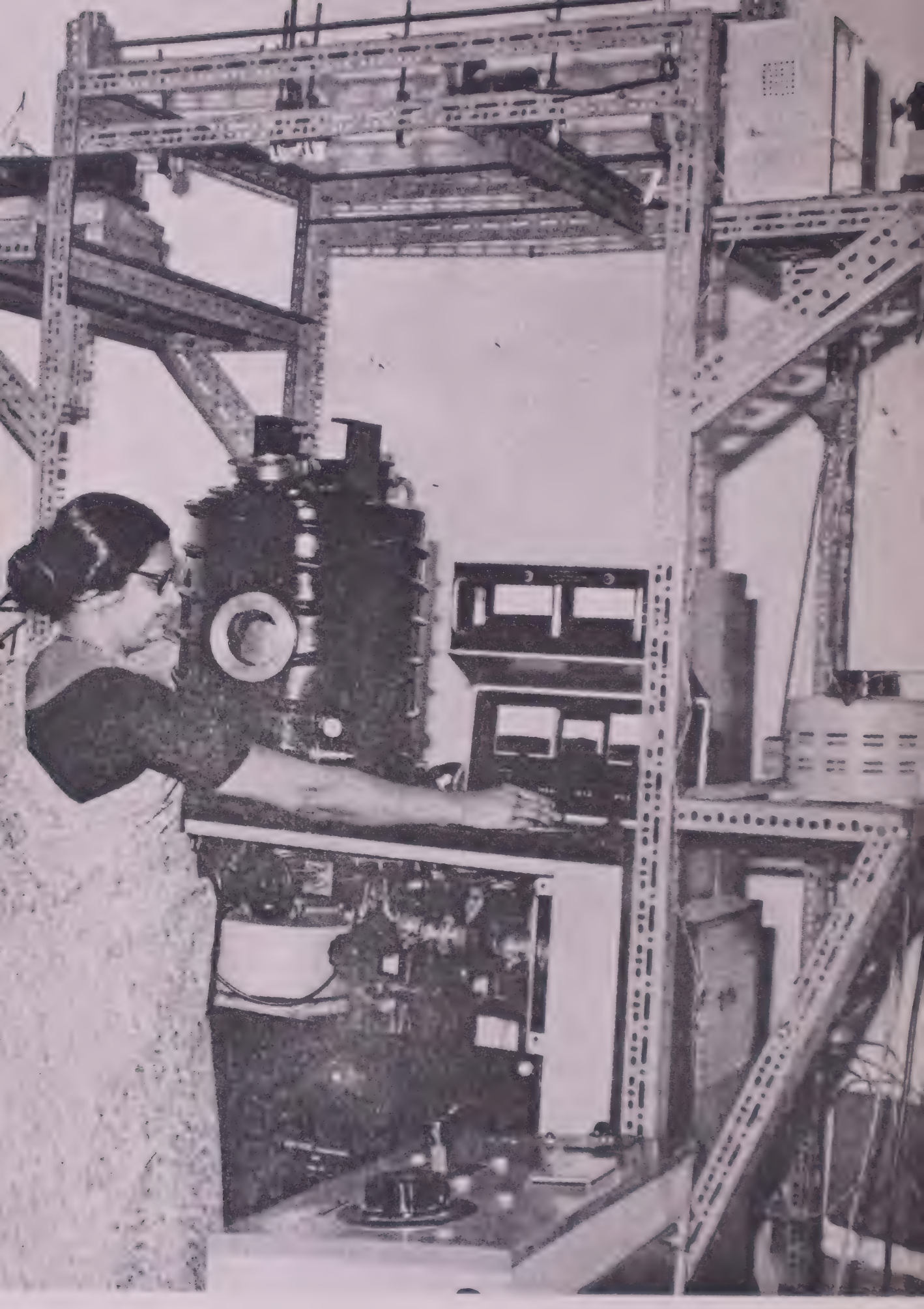
ELECTRONICS

Radars and even the simple communication systems in use by the defence forces have to depend upon research in electronics which is one of the important pursuits of the Defence Research and Development Organisation. Some of the important electronic equipment developed are: radars and sound ranging equipment, communication systems, medical electronic equipment, electronic exchanges,anntennas and tropos - catter communication systems, etc. Work is now in progress on some advanced radars and other sophisticated equipment. A secondary surveillance radar has gone into production successfully at one of the Public Sector Undertakings. This development has received national recognition.

AERONAUTICS

The Air Force is not only the most glamorous of the Defence Services but also the most technology-intensive. Research in various aspects of gas turbine engines, its variants and avionics systems is among the more important items necessary for aeronautics. Work has been taken to a very advanced stage for developing gas turbine engine technology. Flight simulation facilities are being set up and projects for the development of

Gas Chromatograph and indigenously developed Cryogenic Cooling Engine



Preparation of Laser Mirrors

training simulators for two Service aircraft are being progressed. Sophisticated flight simulation facility for evaluation, design and development of aircraft and systems has been set up.

An important major project recently taken up by DRDO relates to the development of Pilotless Target Aircraft (PTA). Due to the high attrition rate and high costs of modern military aircraft, PTAs play an important role particularly for training activities.

NAVAL SCIENCE

The Navy depends for its effectiveness on technology in its physical, chemical and metallurgical aspects and underwater weapons. Various projects to attain self-sufficiency in the field of sonars, torpedoes and other seaborne equipment have been undertaken with considerable success.

Studies were also undertaken in the areas of marine corrosion and marine bio-deterioration in tropical waters and development of technologies for protection of naval ships and underwater structures against corrosion and fouling. A variety of paints and an impressed current cathodic protection system for protection of ships, hulls and other underwater structures have been successfully developed.

Spin-off from these technologies has been utilised by the Oil and Natural Gas Commission and the Shipping Corporation of India. It is also planned to undertake work in polymers, ceramics and other materials of interest to the Navy.

ENGINEERING

A great deal of structural and civil engineering is an obvious part of the DRDO effort. For the indigenous development of military boats and bridges, considerable expertise has been built up and major development projects are in hand. Work on the development and production of vehicles for various service needs, general stores, materials technology and applied sciences (metals, ceramics and chemicals) is also in hand.

Snow and Avalanche Studies along strategic highways have been carried out during winter with a view to suggest ways and means for keeping the road axes open for most part of the year. The avalanche forecasting and warning system has been further improved and its scope extended. This has proved very useful in saving valuable human lives.

Research & Developmnt activities in the field of high altitude problems are being intensified. It is proposed to form a Himalayan Research complex not only to coordinate the activities of the Field Research Laboratories in the high altitude areas but also to deal with other technical problems of the Services in the border areas and to find solutions with the help of the other concerned DRDO Laboratories.

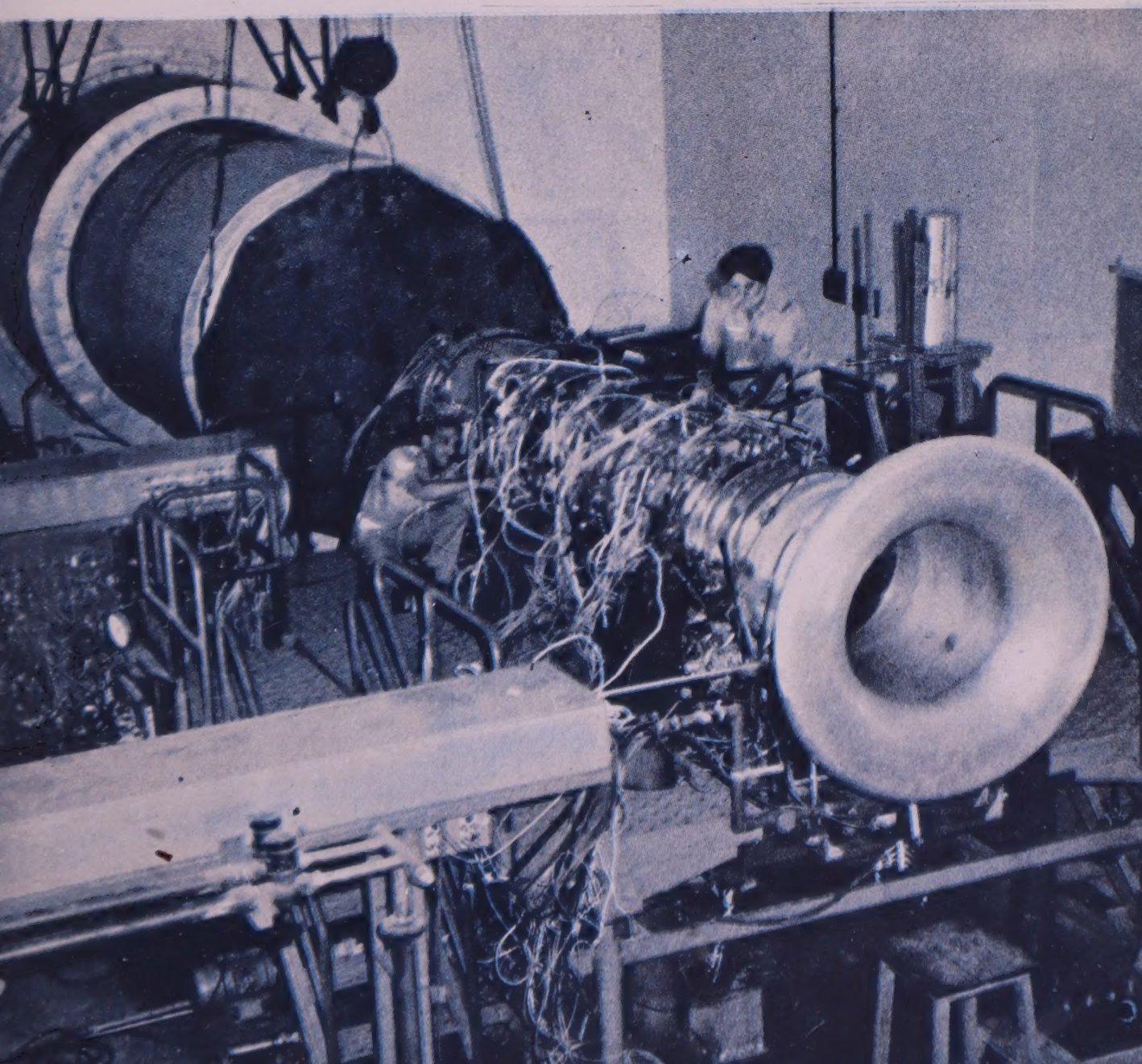
CONCLUSION

It is obvious that India's defence needs call for an intensive use of science and technology and DRDO's current and plan-

ned activities will lead to generation of greater self-reliance in the near future.

The Defence Research and Development Organisation is re-orienting its activities to achieve greater expertise for design and development of major systems required by the Services. The organisation has delineated for itself certain areas of thrust and has been progressively launching major programmes of work in these areas.

GTX Demonstrator Engine on Test Bed



New policies and procedures for intake and career advancement of scientists in DRDO have also been introduced and a large number of scientists have been afforded promotion based on the assessment of their performance, thus removing stagnation of scientists of various categories and providing a climate more conducive to better R & D work.

OTHER TITLES IN THIS SERIES

Science and Technology in India
India and the Atom
India's Progress in Space
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Environmental Science and Technology
Agricultural Science and Technology
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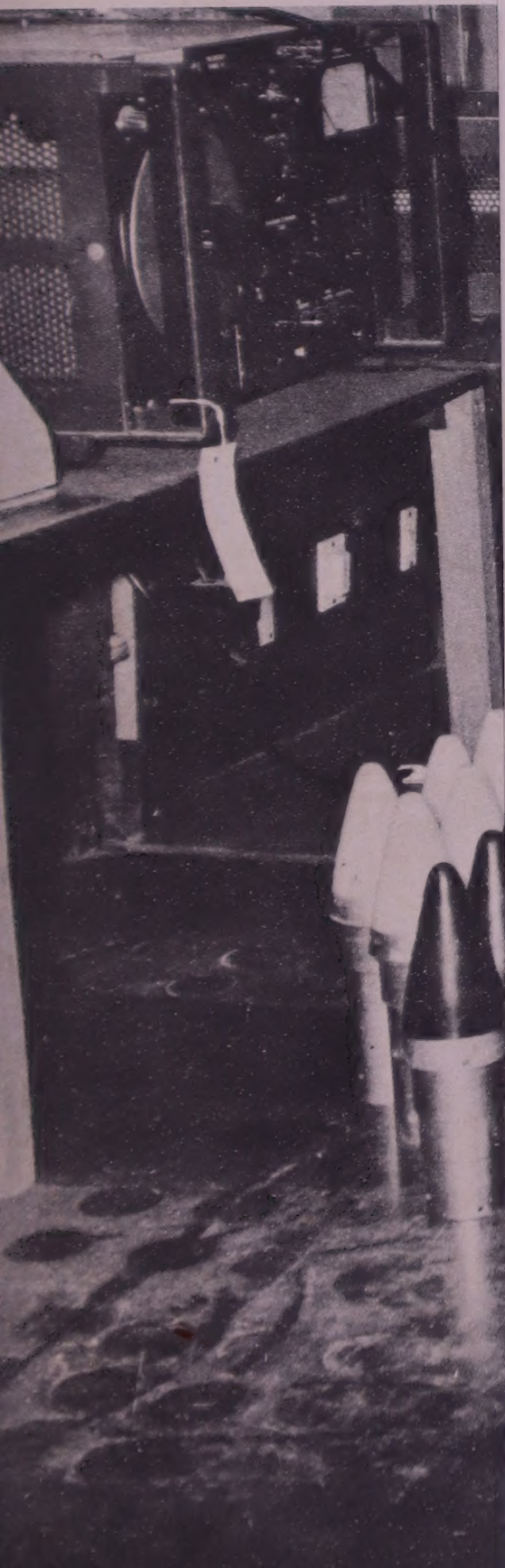

Defence science as such is not essentially different from science in general. Science is science, in whatever shape or form it is presented. Although a superficial dressing to the basic science may be required so as to make it applicable to and meet the specialised requirements of Defence, it does not in any way involve either extreme orientation of the fundamental principles of science or a total change in universally accepted laws which are "inexorable."

Dr. S. Bhagawantam

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On the Test Track of the Vehicles
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